WILDLIFE

in North Carolina

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MAY 1948

Law Enforcement and Education

(The following paragraphs are extracted from an address by Executive Director Clyde P. Patton at the semi-annual meeting of the North Carolina Wildlife Federation, Charlotte, April 22, 1948.)

"If every North Carolinian who shouldered a gun or wet a fishing line bought a hunting or fishing license and observed the regulations established to control the seasonal harvest of surplus game stocks, there would be no need for the Commission to spend one-third of its total revenue for maintaining a law enforcement system. This is not the case, however, and will never be the case. As game supplies have decreased and human populations and activities have increased, laws and regulations have been established for the purpose of dividing up the harvestable surplus equally among all citizens who wish to participate at the nominal cost of a hunting or fishing license.

"This idea forms the basic principles upon which all other game restoration work rests. Unless we as good sportsmen eliminate the habitual game hog and pot hunter forcefully and justly, then divide the surplus equally among all interested citizens and save a fair number of breeders to produce next year's crop, the future looks dark enough. To do this we must first plan and establish our regulations carefully and then enforce them diligently.

"How can we improve our present system? More funds to employ a larger staff of better equipped officers is the best answer of course, but until there is more money available to spend on game law enforcement, there are three things that can and should be done: (1) increase law enforcement manpower through carefully selected deputy appointments; (2) provide for more uniformity in game laws and regulations; and (3) educate the people."

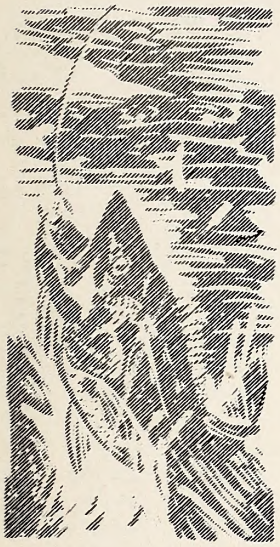
* * *

"Education is important in supporting our law enforcement program. It is also vital to the health and vitality of all other phases of our program. I believe it is second only to law enforcement in the overall effort.

"We are all well aware of the many different ideas which are expressed among sportsmen on matters pertaining to the management of any specific bird or animal. Some are right; some are wrong—some based on facts; some on imagination—some stated because of an interest in the wildlife resources for the good of our society; some because of purely personal interests. An all-out education effort to present the facts in a manner that they can be understood by the general public will do more to coördinate and guide these ideas into the proper channels than any other program that I know of. The Commission has established an educational division whose primary purpose is to prepare attractive printed material and take steps to see that this material is widely circulated to our employees and to as many interested people as possible throughout the State. It is hoped that local wildlife clubs will assist with the distribution of this material when it becomes available and that it will be of value to them in their program."

WILDLIFE IN NORTH CAROLINA

A bimonthly magazine devoted to the protection and restoration of our Wildlife Resources and to the improvement of hunting and fishing in North Carolina



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IN THIS ISSUE

May 1948 **Vol. XII No. 3**

COVER

Lake James is one of North Carolina's many beautiful artificial lakes. It is rapidly becoming a favorite vacation spot and a site for summer homes.

—Photo by Rod Amundson.

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Wildlife in North Carolina recognizes the need for close cooperation between State and Federal conservation agencies and the people who hunt and fish—to bring about a restoration of our renewable resources. The Editor gratefully receives for publication all news items, articles, photographs, and other material dealing with the various activities which combine to make North Carolina a better state for hunting and fishing. Full credit is given for all material published.

Application has been made for entrance as second class matter at the Post Office at Raleigh, North Carolina, February 23, 1948, under the act of August 23, 1912.

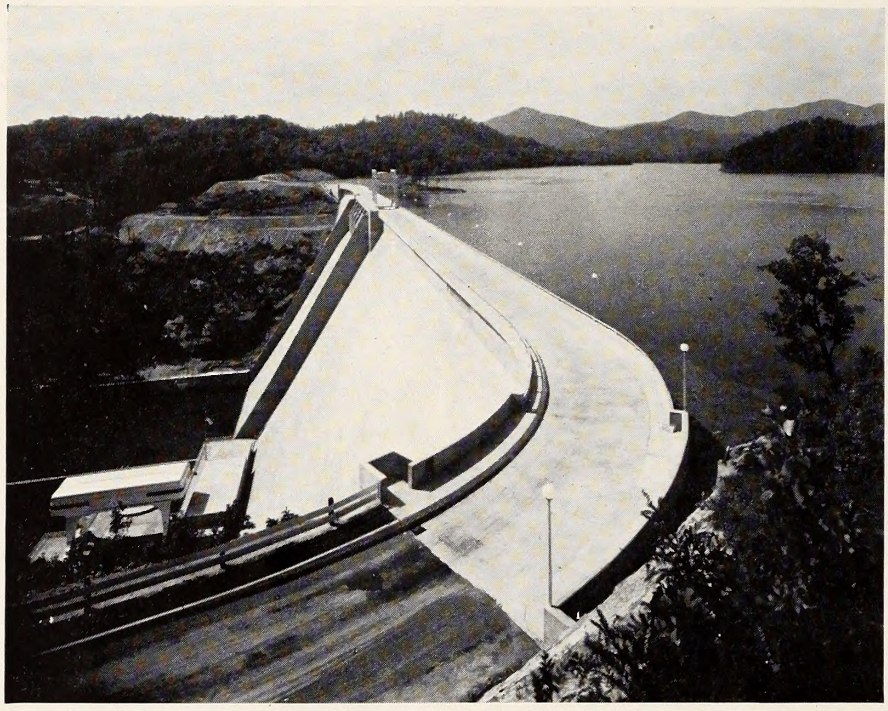
SUBSCRIPTIONS—Fifty cents per year, one dollar for two years. Make remittances payable to WILDLIFE RESOURCES COMMISSION. Any employee of the Wildlife Resources Commission may accept subscriptions, or they may be forwarded to Postoffice Box 2919, Raleigh, North Carolina.

The best magazine in the world is worthless if no one reads it. WILDLIFE IN NORTH CAROLINA may not be the world's best, but we plan to improve it with each successive issue. You can help us increase our circulation by showing this copy to your friends and giving them an opportunity to subscribe. This is *your* magazine. You can help to improve it by helping to increase the circulation.

ROD AMUNDSON, EDITOR.

FISH RESOURCES SURVEY
of the Hiwassee Watershed

By JOSEPH R. BAILEY *



Hiwassee Dam stores water from a watershed 625 miles square.

The Hiwassee watershed occupies the southwestern corner of North Carolina, an area of some 625 square miles characterized by rolling hills and fertile valleys dominated by a few high mountains (see map). In both relief and average altitude the other western watersheds of the state exceed the Hiwassee, but not in interest to the acquatic biologist. The reasons for this interest are twofold. Of all the western areas of the state this watershed has been studied the least, and, prior to the survey in 1947 little was known of its aquatic fauna. The second reason is that the development of the T.V.A. program has wrought profound changes in the watershed within recent years, and the results of this tremendous experiment are still unfolding. The changes which take place in nature in reestablishing equilibrium conditions after being upset by the hand of man tell the biologist the answer to many of his problems and at the same time raise new questions. The T.V.A. program has been an experiment on a far grander scale than is possible in the laboratory.

The construction of three huge dams has impounded the Hiwassee River into many deep lakes which fill the valley and extend long fingers up each tributary stream. The Appalachia Reservoir has its dam almost at the Tennessee border. At the head of this impoundment is the Hiwassee dam which backs up the water as far as Murphy; the two lakes covering over thirty miles of former river channel. Well above this the Chatuge dam forms a reservoir which straddles the Georgia line.

The effects of these dams in creating entirely new lake habitats and in preventing the upstream movements of fishes are obvious. Less obvious is the effect of the controlled flow of the Hiwassee River below Chatuge Dam and of the Nottely River below the Nottely Dam in Georgia. Formerly the flow of these streams varied with the precipitation, high water levels following shortly after heavy rainfall or periods of melting snow and ice. Under the present T.V.A. policy these rivers attain their highest levels during periods of relative drouth when the upper impoundments are drawn down to fill the lower reservoirs to provide a constant supply of water power. At seasons of normal high water the lesser tributaries are sufficient to maintain the flow in the lower reservoirs, and the upper ones are closed to permit them to fill thus preventing flood conditions.

In the course of the 1947 survey there was insufficient time to study in detail the biological effects resulting from these profound human disturbances of the environment. Our efforts were devoted to a general survey of present stream conditions during the summer season.

General Fishing Conditions

With the formation of extensive lake conditions in the reservoirs of the Hiwassee watershed, and the introduction of game fishes into them by the T.V.A. biologists, the area of fishing water has been greatly increased, and much of the local fishing pressure has been diverted from the streams to the lakes. Lakes can stand much heavier fishing per unit area than streams and still yield satisfactory catches.

Trout streams are not abundant in the Hiwassee system, and are restricted chiefly to the higher slopes of the Tusquitee and Unaka mountains. At the lower altitudes prevailing elsewhere the streams become too warm and carry too much silt to maintain good trout populations. Thus the trout waters are found in the headwaters and tributaries of the Valley River, Tusquitee and Fires Creeks, and a few of the streams draining into Appalachia and Hiwassee reservoirs.

Fires Creek and its tributaries are in one of the areas under the coöperative management of the U. S. Forest Service and the North

* Stream survey party leader. Other members of the party were Fred Morrison, Yates Barber, and Frank Cross.

Carolina Wildlife Resources Commission. Fishing in the crystal waters of this system is regulated to provide sustained yields to the sportsman throughout the season. The good visibility afforded the trout by the extraordinary clarity of the water offers a real test of the fly fisherman's ability to outwit his wary prey. Rainbow trout are the dominant species in the Fires Creek system, but brook trout are found to the exclusion of that species in some of the small tributaries which have falls forming an effective barrier to the introduced rainbows.

Among the trout streams outside of the Fires Creek area may be mentioned the headwaters of the Valley River and its tributaries, including Junaluska Creek, the northern tributaries of Tusquitee Creek, and the upper courses of the streams draining the south slope of the Unaka Mountains, although these latter are definitely marginal at the present time.

Some of these streams are well adapted to trout, but not being under the careful regulation of the management area, they are fished out early in the season or soon after being stocked, and very few legal fish are taken through the rest of the season. Improvement in this situation will depend largely on the interest and coöperation of the local inhabitants.

The larger warm water streams receive considerable attention from local pole and trotline fishermen. Brasstown Creek and Hanging Dog Creek provide carp, catfish and occasional bass. The Hiwassee and Nottely rivers, in addition to these species, offer a variety of warm-water game fishes, including crappies, sunfish, bluegills, small-mouth and spotted bass. The other small and warmer streams are of little value for fishing.

Industrial Pollution

Pollution, erosion, and silting, bugaboos of the fisheries biologist in well settled regions, are relatively less serious in this watershed than in some of the neighboring systems in the state. Whereas the French Broad, Pigeon, and Little Tennessee systems must contend with paper mill wastes of the most damaging sort, as well as textile mill and tannery wastes, the Hiwassee has only a tannery on the Valley River at Andrews to provide industrial pollution. Tannery pollution, though unsightly, is not particularly damaging to fish life. Gravel washing, another serious source of pollution in other watersheds, is uncommon in the Hiwassee.

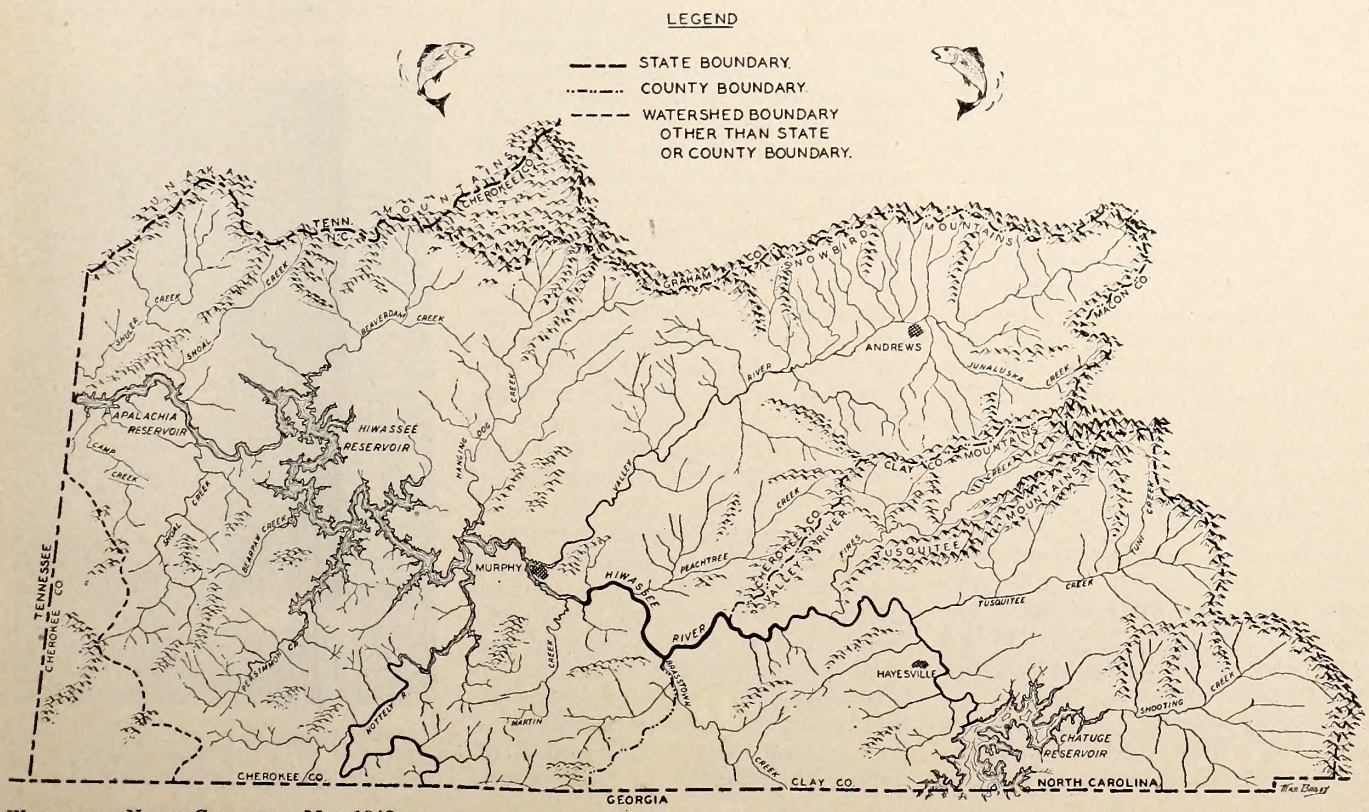
Erosion and Silting

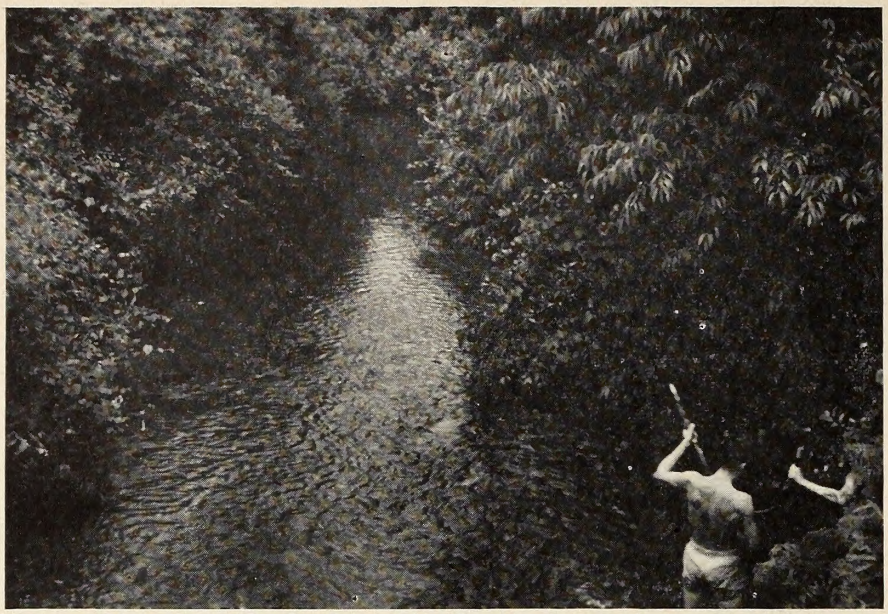
Under conditions of widespread agricultural use of land, erosion and silting cannot be eliminated; only minimized. Fortunately in this watershed the streams most susceptible to damage from this source, the cool clear trout waters, are found on the upper slopes where wooded cover has been allowed to remain. Most of the smaller lowland streams carry a considerable amount of silt but are of little value as fish producers, although the possibility remains that a few of them might support trout if their watersheds were completely wooded and thus protected against extreme water level fluctuations and heavy silt loads following every rain.

Warm water fishes inhabiting the large lowland streams are pretty well adapted to living under conditions of moderate silt load which prevail in them.

Another effect of the lack of adequate stream cover is exposure to direct sunlight, thus warming the stream waters unduly. This effect gives several otherwise favorable trout streams a marginal rating. With restoration of immediate streamside cover they should become productive

SOUTHWESTERN NORTH CAROLINA —— HIWASSEE WATERSHED





Biologists take food samples from a trout stream in the Hiwassee watershed.

of good trout fishing. Tusquitee Creek is an excellent example of such a stream. Its temperature in the warmest part of the summer averages 70-74 F. which is considered marginal for rainbow trout. No trout were found in its lower portions. Long stretches, especially in its upper reaches, are devoid of sheltering trees and shrubs. The direct exposure thus permitted on a hot summer day is certainly a contributing cause to the lack of trout. Trees and shrubs along the banks would not only tend to stabilize and lower the temperature, but would increase the shelter and hiding places for fish and add materially to the food supply. Many terrestrial insects drop from overhanging limbs into the water to provide tasty morsels for hungry fishes.

Chemical Data

As in other mountainous sections of the state, chemical analyses of the waters in this watershed proved very uniform and generally favorable for fish life. At eight stations where detailed analyses were made the samples were slightly alkaline, the Ph varying from 7.1 to 7.3. Oxygen content was near saturation with values of 10.5 to 11.0 parts per million. Free carbon dioxide was present in from 1.0 to 1.5 parts per million, and the softness of the water is indicated by the 3.0-7.0 parts per million of carbonates which were found.

The Hiwassee water also agrees with the other western systems in the relative scarcity of aquatic bottom organisms which furnish much of the food for game fishes. The number of organisms per square foot ranged from 1½ to about 22, and the volume from a trace to .23 cubic centimeters, with a single station on Fires Creek producing 1.2 cc. Elsewhere precise determinations were not made but estimates of poor conditions (less than 1.0 cc. and less than 50 organisms) were made 19 times, poor to medium 4 times, and medium only once.

Shelter and Cover

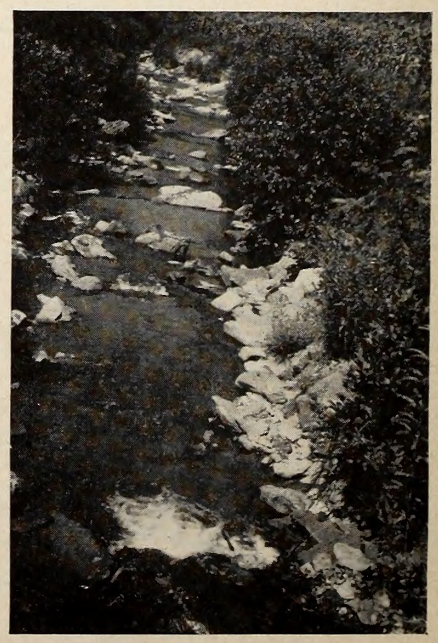
More is required of a good trout stream than favorable water and food. There must be adequate shelter in the form of overhanging banks, bushes, rocks, logs etc. to provide fishes with shelter from their enemies (including fishermen). The fish must have deep pools, preferably spring fed, to serve as home territories, and in general the larger the pool the larger its finny occupant. The cool depths provide suitable retreats during the heat of the day. Shallow gravel riffles alternating with the pools are necessary as spawning grounds and also provide the greatest abundance of aquatic insects.

A summary of these characteristics for fourteen possible trout streams in the watershed indicate that conditions are far from optimum, and go a long way in explaining the scarcity of trout. On a rating system of good, average, and poor, 6 streams received a pool rating of average and 8 of poor. For shelter 1 rated good, 4 average, and 9 poor. Stream cover was considered good at 3 stations, medium at 5 and poor at 6 others. Quiet back-waters filled with silt and aquatic vegetation are excellent food producing areas and are virtually absent in this area due to the scouring action of the mountain freshets.

For the future outlook these figures are not so dismal as they seem since they are largely correctable, and interested local groups could effect much improvement along these lines. Pools and shelter can be provided on a more or less permanent basis by strategic placement of boulders and large rocks to form pools and backwaters and to channel the current, forcing it to dig out holes. Stream cover is simply a matter of encouraging shrubs and small trees to grow in a canopy over the water. Where water temperatures tend to be high, as in the area under consideration, this cannot be overdone as far as the fishes are concerned.

Recommendations

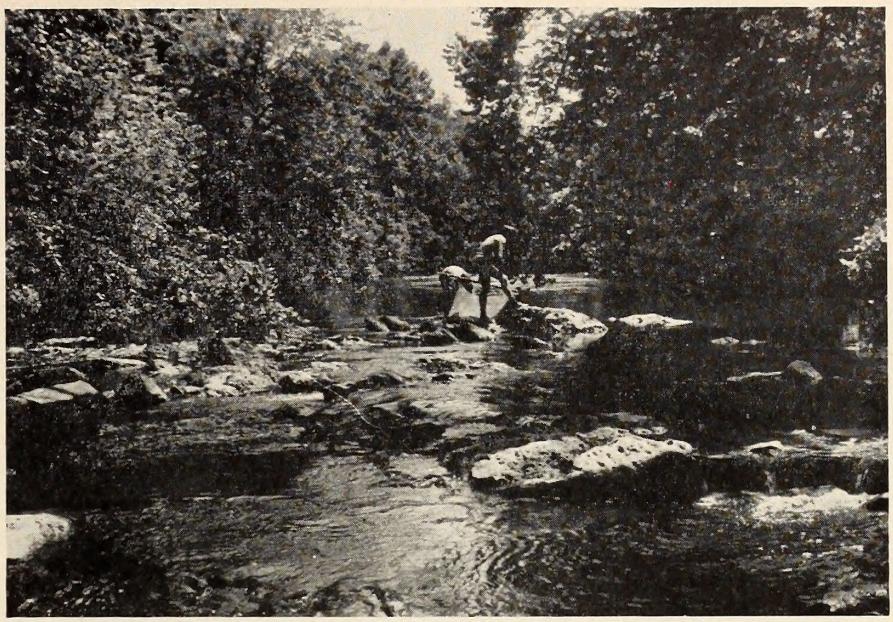
With the relative abundance of warm-water fishing provided by the local reservoirs and the Nottely, Valley, and Hiwassee Rivers, efforts in stream management of this system should be directed primarily toward improvement of trout fishing. There is plenty of room for sound management practices in this area. Few of the upland creeks attain tempera-



Streams like this are good trout habitat if they are cool enough and supply plenty of natural food.

tures which are intolerable to trout, hence they may be considered potential trout waters, but many are marginal and temperatures 2-4 degrees lower would be much more favorable. A marginal stream is one which will not provide sustained fishing under present conditions without undue attention, but which possesses the fundamental characteristics of a productive stream, and, if adequate remedial measures are taken, would maintain satisfactory fishing under normal management practices.

Two things need be done to remove a number of streams from the marginal class (see table).. First, improvement of the streams themselves by providing increased cover and shelter, and rendering them less available to the too ardent fisherman. Second, closer adherence to ethical if not legal fishing practices. A small trout stream will not produce the legal limit of fish to very many fishermen throughout the season. People fishing small brooks should be satisfied with fewer fish if they wish to enjoy successful fishing again. Trout stocked at legal size produce the best returns, but they are costly and in the first few days after stocking are easily caught. After a few weeks they become accustomed to their new environment and will provide good sport. If the local inhabitants have an interest in sustained trout fishing, or desire trout fishermen to pursue their favorite sport in their area, they can see to it that the planted fish get a fair start. With adequate cover it will be difficult for sportsmen to take all the legal fish in a few days. Leaving a breeding stock at the close of the fishing season would permit natural reproduction to carry much of the burden. Natural reproduction, except on Junaluska Creek and perhaps in the Fires creek area is far below standard.



Nets are used to evaluate the trout food supply. Rocks in this stream create pools for trout to hide in.

Recommended management by stream mileages is shown on the accompanying table. It will be noted that brook trout water is scarce in this system. Besides a clear cold water habitat brook trout require segregation from rainbow trout in order to prove really successful. This condition seldom prevails in the Hiwassee system. In Hyatt Creek it is provided by the Valley River below, which is not favorable rainbow water. In the Fires Creek system isolation is provided by impassable falls which prevent the upstream movement of the rainbows predominating below. Rainbow trout is the most suitable species for most of the streams. None of the streams are particularly well suited to brown trout although the species is present in the Valley River and perhaps elsewhere in the system. It prefers deeper and slower water than the other species, which conditions are not found with favorable temperature characteristics in this system.

Streams unsuited to trout, but of sufficient size, are good habitats for several warm-water species. Here the sport fisherman will find the bass and panfish as scrappy as trout, and an anticipated fish dinner is more apt to be realized from these streams than from trout brooks. Good fishing in these streams should be maintained, if for no other reason than to give every lad his natural birthright of an "old fishing hole."

Hiwassee—Mileage of Waters Suitable for Management

STREAM * Marginal	Brook trout	Rainbow trout	Bass and panfish
Shuler Creek (Cane Creek)		5½*	
Shoal Creek (Sular Creek)		3½*	
Beaverdam Creek			4½
Hanging Dog Creek			2
Davis Creek		3*	
Shoal Creek (so. tributary)		3*	
Nottely River (to Ga. border)			11
Rapiers Mill Creek			3
Valley River (below Andrews)			17
Hyatt Creek	2½		
Tatum Creek		5*	
Junaluska Creek		6½*	
Valley River (above Andrews)		8	
Hiwassee River			20
Peachtree Creek			3
Brasstown Creek			8½
Fires Creek (system)	4	11½	
Tusquitee Creek		8*	
Tusquitee Creek tributaries		8½	
Total Miles	6½	65½	69

Five hundred and ninety-one persons were arrested for game and fish law violations during April, 1948. Help protect your hunting and fishing rights by reporting game law violations to the nearest peace officer.

Training for Wildlife Management Careers

N.C. State is Producing Wildlife Experts

By GEORGE S. FICHTER

This student is getting practical experience in food habits analysis.

Game managers are versatile. They attack the problems of wildlife with the keen insight of a research scientist and the speculative caution of a Scotch economist. They are able to communicate their propositions by pen or by stump and can work as efficiently in a quagmire as behind an executive's desk. Good game managers are, in short, far more than mere professionals.

For that reason every student in the department of wildlife conservation and management at North Carolina State College is given careful and intensive training. The department is determined that every graduate will be a competent addition to the wildlife profession. It calculates its success in terms of quality rather than numbers.

Our state stretches from mountains to seashore, and only a few states have as great a variety of game animals. The task of the game managers and conservationists is to control these animals so that sportsmen, landowners, and general public are mutually satisfied. Locally trained men are most desirable. They understand the problems best, but until the wildlife curriculum was established at North Carolina State College in 1937, it was necessary to rely on men from other sections of the country.

Fourteen of the seventeen graduates to date are natives of North Carolina, and most of them are now working in the state. Thirteen of the degrees were granted prior to 1941, when the war interrupted the supply of students. Only two students completed their work during the war years, and the first postwar graduates were Malcom G. Edwards of Asheville and Titus Stuart Critcher of Williamston. Both of them received their Bachelor of Science degrees in June, 1947.

This year's enrollment of thirty wildlife majors is record breaking for the college. Twenty-eight are working toward their Bachelor's degree. Ray Allison and Titus Stuart Critcher are graduate students.

Dr. Frederick S. Barkalow, Jr., director of the wildlife program is doubly endowed. He has both academic and practical experience, the ideal for all effective teaching. He knows exactly what should be taught and how to teach it.

Dr. Barkalow is a native of Georgia and graduated from the Georgia Institute of Technology in 1936. He received both his Master of Science and Doctor of Philosophy degrees at the University of Michigan. For over two years he taught zoology at Alabama Polytechnic Institute and was at the same time in charge of their museum. Over fifteen hundred specimens collected and prepared by him are in the museums of Alabama Polytechnic Institute and the University of Michigan.

In 1939, Dr. Barkalow initiated the Pittman-Robertson program in Alabama and supervised its inventory of wildlife resources until he was called to the army in 1941. He was discharged in 1946 with the rank of lieutenant-colonel.

He has boundless enthusiasm for all things related to wildlife. His hobby of fly-tying provides him with angling lures of his own handicraft. He is a proficient trainer of bird dogs, and over sixty of his wildlife pictures have been used by newspapers, sporting magazines, and technical journals. In addition, he is author of seventeen published articles.

Dr. Barkalow agrees that every wildlife student should have a sincere interest in the out-of-doors, but he knows from experience that a lot more is necessary. He welcomes students who are willing to spend the necessary time and effort in developing themselves. He discourages those who are not.

In the requirements for a wildlife major, a firm understanding of the biological sciences is prime. During his four years of training, every student takes a number of specialized courses in zoology. Most emphasis, of course, is placed on game management and conservation. Such prominent spokesmen as Aldo Leopold, Ira N. Gabrielson, and Edward H. Graham become well-known to every student, and the students are just as familiar with the technical journals of wildlife and conservation before they graduate. In addition, there are many courses in various zoological subsciences: entomology, comparative anatomy, physiology, ornithology, and ecology.

Practical experience is gained from work in the laboratory and from field trips. All students learn the technique of preparing

museum skins and skeletons and the stomach analysis method of determining food habits. In addition, laboratory work trains students to collect and record valuable data, much of which must be condensed on labels and in workable filing systems.

Numerous field excursions are taken in the vicinity of Raleigh, but the most important occur during the fourth year when three long field trips give the students an opportunity to see actual game management practiced in action. Two trips during the fall hunting season acquaint the students with state game refuges and controlled hunting. This year's class participated in the November deer hunt at Holly Shelter, and in December they hunted geese at Lake Mattamuskeet. The final trip is taken during the spring session. In April, the class went fly-fishing in the mountains. Trips of that sort give textbook topics a real meaning.

Zoology is not the only course of study required of the wildlife students at North Carolina State College. The students take almost as much botony, and they also study a variety of other subjects. Dr. Barkalow guards his students carefully from over-specialization, and his wildlife curriculum includes courses in mathematics, chemistry, physics, economics, sociology, surveying, and history. Since many men working in the wildlife profession now recognize the deficiency of their training in the preparation of coherent, objective reports and in the ability to express themselves before an audience, Dr. Barkalow has emphasized basic courses in English and public speaking.

Throughout the entire period, wildlife students study and work with forestry and agriculture majors. It gives each an opportunity to understand and appreciate the objectives of the other. The three are closely allied. They deal with harvestable crops of the land and are concerned with the ways and means of making the land produce its maximum. Hence, the close coöperation of the three is facilitated.

What sort of work faces the graduate from the wildlife curriculum? There are five general categories of work: (1) administrative (2) law enforcement (3) refuge managing (4) research and (5) teaching. The one which a student chooses depends on the amount of his training and his personality.

Most of the work is done with the state and federal agencies charged with management and conservation duties. A few work for sportsmen's organizations which have come to recognize the value of scientific aid in controlling game.

Administrative and law enforcement positions require contact with the public. Men in those positions have the responsibility of coördinating and directing the activities of the various research personnel into common and practical channels. They maintain the trust and support of the public by keeping them informed about what is being done and why. They prevent violations of the laws established to protect wildlife and help further the concept of conservation as "wise use."

Refuge managers have an opportunity to combine scientific research and public contact. They apply management practices on game refuges which each year supply a surplus stock either within the area at specified times or in the surrounding region. Research technicians solve the innumerable problems which arise. They explore the unknown, attempting to find an answer which is economical and practical to put into operation.

The stomach of a fox is removed for later examination of its contents in the wildlife laboratory.

Wildlife technicians must be able to identify not only game species, but many other wildlife forms which have a great deal of bearing on the abundance or scarcity of game.

NORTH CAROLINA'S BAY LAKES

By DAVID G. FREY *

Story of Origin

Most of North Carolina is geologically old and consequently has few natural lakes in its well-drained surface. Only the coastal plain, which is the most recently formed part of the State, has natural lakes in any numbers. Here there are hundreds and even thousands of oval depressions all lined up in a general northwest - southeast direction. They are not confined to North Carolina but extend all the way from northern Virginia to southern Georgia. Because of the kinds of trees occuring in them these basins are called "Bays," and because they were first studied near Darlington, S. C., they are now known as "Carolina Bays," regardless of their location.

These Bays, ranging in size from only a few hundred feet to several miles in length, are an enigma to the geologists, who cannot agree among themselves as to how they were formed. One theory, so spectacular it immediately fires the imagination, is that the basins were all formed about the same time by a large shower of meteorites striking the earth from a northwest direction. An opposing theory is that the basins were first excavated by water from artesian springs, and then enlarged by subsequent wind and wave action. No other part of the world has basins similar to these.

Whatever the orgin there is little doubt that at one time all these Bays were filled with water, forming a lake area as extensive as those existing at the present time in the glaciated region of northern Minnesota, Wisconsin, and Michigan, or in Finland. Today all except a few of the bay lakes have disappeared through filling in of the basins with peat deposits and lowering of the water table.

In the entire coastal plain of the Carolinas, Bladen County is the region most richly supplied with bay lakes. There are at least 9 in the county, three being used extensively for recreational purposes. Fishing, however, has not been very good in these lakes.

Nature of the Survey

In order to learn about the lakes as a guide towards better use of them for recreation purposes, the North Carolina Wildlife Resources Commision set up a team to study the lakes during the summer of 1947. From headquarters established at White Lake, the lakes were investigated one at a time, spending two to three weeks on each. The work included sounding the lakes thoroughly for the preparation of hydrographic charts, plotting the distribution of the types of bottom, making chemical analyses of substances dissolved in the water, determining the quantities of small animals living suspended in the water (plankton) or living in the bottom deposits, investigating the kinds and abundance of aquatic plants, and finally determining the kinds of fish present and their relative abundance.

Production in a body of water is an extremely complex thing, but in general it is based upon the amount of food which can be manufactured by plants living in the water, since animals do not have the same ability to combine carbon-dioxide, water, and energy from the sun to make simple organic compounds. Of greatest importance in this process are nutrients dissolved in the water (phosphorus and nitrogen in particular) and the amount of light which can enter the water. The latter is affected by suspended matter and brown color in the water, both of which reduce the extent of light penetration. If a lake is located in a region where the soils are poor agriculturally, there will be insufficient quantities of plant nutrients flowing into the lakes. Likewise, if a lake is so located that it receives extensive deposits of silt from its watershed, or is so shallow that winds can readily stir up material from the bottom, or if it receives dark colored swamp drainage, production will necessarily be curtailed through the reduction of light penetration. Light and nutrients are essential for the functioning of the microscopic plants (phytoplankton) in the water, and they form the bottom of a pyramid of production which has fish at the apex. For this reason it is necessary in considering the production of fish in a lake to consider all the many interrelated factors upon which fish production is dependent.

Employing outlines of the lakes obtained from aerial photographs of the region made in 1938 for the U. S. Department of Agriculture, the lakes were thoroughly sounded by means of a stadia rod for measuring the depth of the water and a plane table and alidade for plotting the locations of the soundings. Samples of bottom sediments were obtained by means of a cup at the bottom of the stadia rod. Water samples obtained from various depths of the lakes were analyzed for hydrogen-ion concentration, color, dissolved oxygen, and acidity. Light penetration was approximated by noting the depth at which a white disc (Secchi disc) 8 inches in diameter disappeared from view. Quantitative plankton samples were obtained by pouring measured volumes of water pumped from various depths in the lake through an extremely fine-meshed net of silk bolting cloth. Organisms living in the bottom sediments were dredged from the bottom, separated from much of the inert material by washing in a scrim net, and then picked out individually in the laboratory. Seines, various types of nets and chemicals were employed to procure samples of the various kinds of fish in the lakes.

Lakes Studied

The five lakes studied in Bladen County were Jones, Salters, Singletary, White, and Black. As a consequence of their common origin the lakes are all quite similar in their characteristics. Each is located in an oval basin of regular outline, except in the case of Black Lake where in some sections there is considerable irregularity in the margin. None of the lakes except Black Lake has any water flowing in at the surface. Maintenance of water level is dependent upon precipitation into the immediate bay in which the lake is located plus the amount which enters the basin

* David G. Frey, Department of Zoölogy, University of North Carolina, and Leader of Lake Survey Party; other members of the Lake Survey Party were: Edward E. Hueske, of the Wildlife Resources Commission staff, T. Stuart Critcher of N. C. State College, and A. Carter Broad, of the University of N. C. at Chapel Hill. All are trained Biologists.

as ground water. The latter may be a substantial amount, because in all the lakes small springs could be readily detected in shallow water along the south and southeast shores.

Reduction in area and volume of the lakes from their former maximum size has occurred primarily through the gradual encroachment of vegetation along the shores. The vanguard of this filling in is the cypress trees. In periods of extremely low water level new cypress trees can become established at the new shoreline. When the water level returns to normal the trees are able to maintain themselves even though completely surrounded by water. Hence, in all the lakes cypress trees and some of the bay trees were found thriving in water up to 4 feet deep while in Jones and Singletary Lakes, especially, rows of cypress trees paralleling the present shores indicate old shore lines at times of low water levels.

The rows of cypress trees help form a bulwark or wall against wave action and currents, permitting sediments to accumulate more rapidly than would otherwise be possible, and affording protection for other plants to become established. Over many years the gradual accumulation of the dead plants and their products is transformed into peat, which forms solid, although swampy, ground around at least part of the lake. Through this process of plant establishment and peat formation the lakes have become greatly reduced in area: Jones Lake is only 34 per cent of its former maximum size, as indicated by the size of its bay, White Lake is 71 per cent of its former size, and the other 3 lakes are intermediate.

Bottom Deposits

Four main types of bottom deposits occur in all the lakes, two of which are primarily organic and the other two primarily inorganic in origin and composition. Along the northwest shore where filling has been most rapid there occurs a zone of brown fibrous peat, consisting of leaves, stems, branches, etc. in partial decay. Such heavy materials cannot be transported very far by wave action, and hence they accumulate near their site of origin. As these deposits of vegetation are acted upon by bacteria and other organisms they are broken down into very fine particles of organic matter which can be transported by currents set up in the lake. These materials tend to accumulate in the deepest parts of the lakes as a soft, black, pulpy peat. The remains of the microscopic plants and animals produced in the water contribute to the formation of this deposit. The dividing line between fibrous peat and pulpy peat towards the northwest end of the lakes is rather indefinite, because the amount of coarse fibers in the sediments increases rather gradually towards shore.

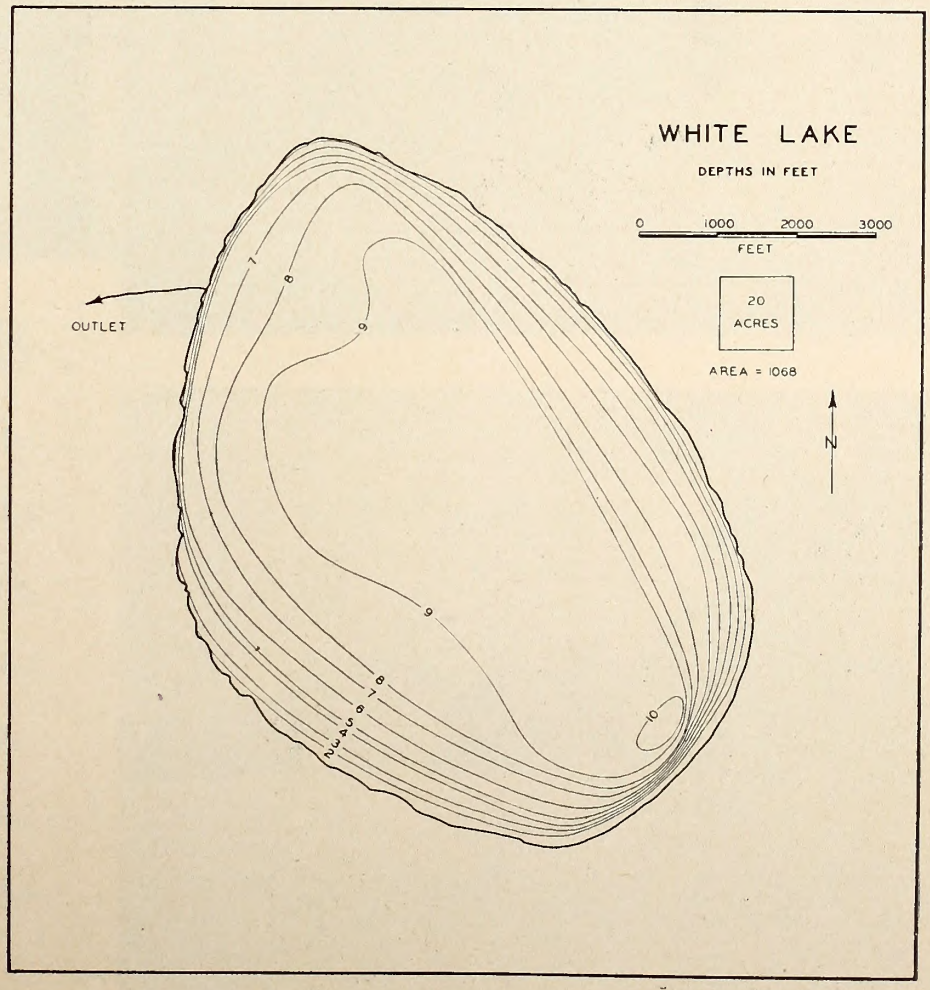
At the south end of the lakes and extending along the east and west shores for varying distances, farther along the east than the west, is a zone of sandy bottom which may be quite wide. In all cases it covers the shallow areas and the slopes down to the place where the flat bottom of the lake begins. Here it meets the pulpy peat.

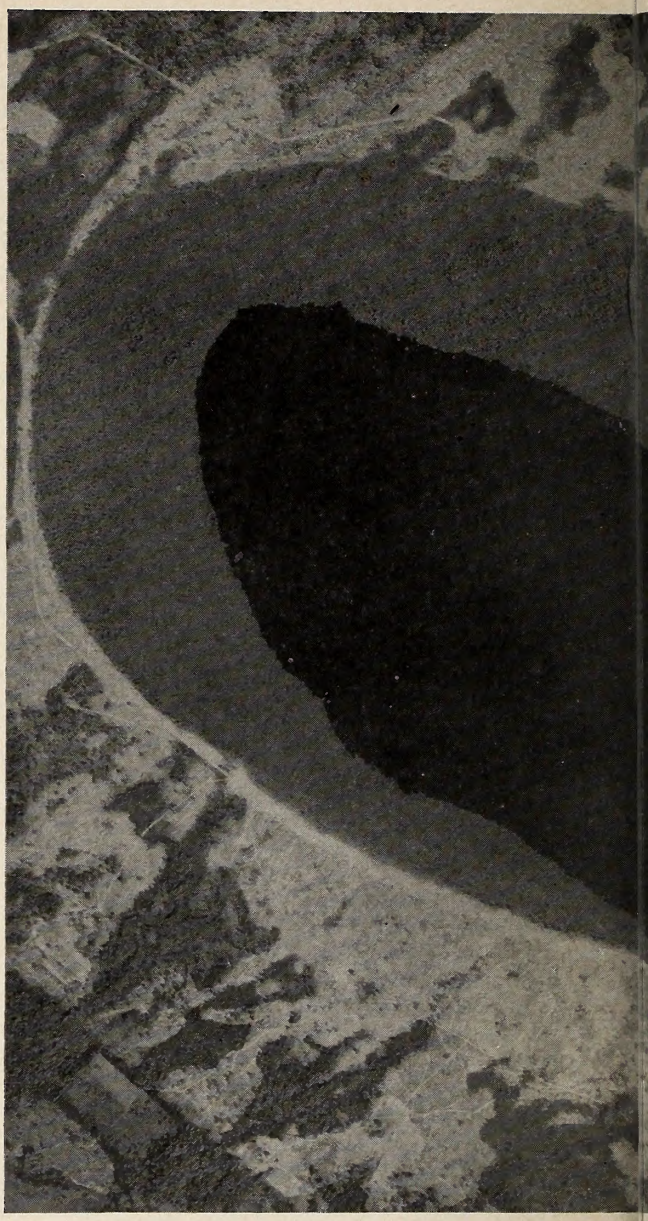
Not occurring at the surface anywhere but underlying the pulpy peat nearly everywhere and sometimes occurring in the sandy zone as well, is a very compact, light gray or blue-gray clay. This material, if shown to be widespread enough and thick enough, could form an effective basin seal, possibly eliminating altogether, where it occurs, the exchange of water between the basin and the surrounding region.

The proportion of the three types of sediments occuring in contact with the water varies from one lake to another. Sand varies from 21 per cent of the bottom in Jones Lake to 48 per cent in the bottom in Black Lake. Pulpy peat, varies from 45 per cent in Black Lake to 71 per cent in Jones Lake, showing an approximate reciprocal relationship with the sand. Fibrous peat varies from a minimum of 4 per cent in White Lake to a maximum of 15 per cent in Salters Lake. The latter figures might be an indication of the relative rates of filling in recent times.

Physical Features of Lake Basins

The 5 lakes being considered are all very similar in their physical characteristics, as might be expected from their similarity of





NORTH CAROLI

Center: This air photo of Singletary Lake show
ring in all of the Bay Lakes.

Upper left: Cypress trees become established
water rises, helping to fill in the shoreline

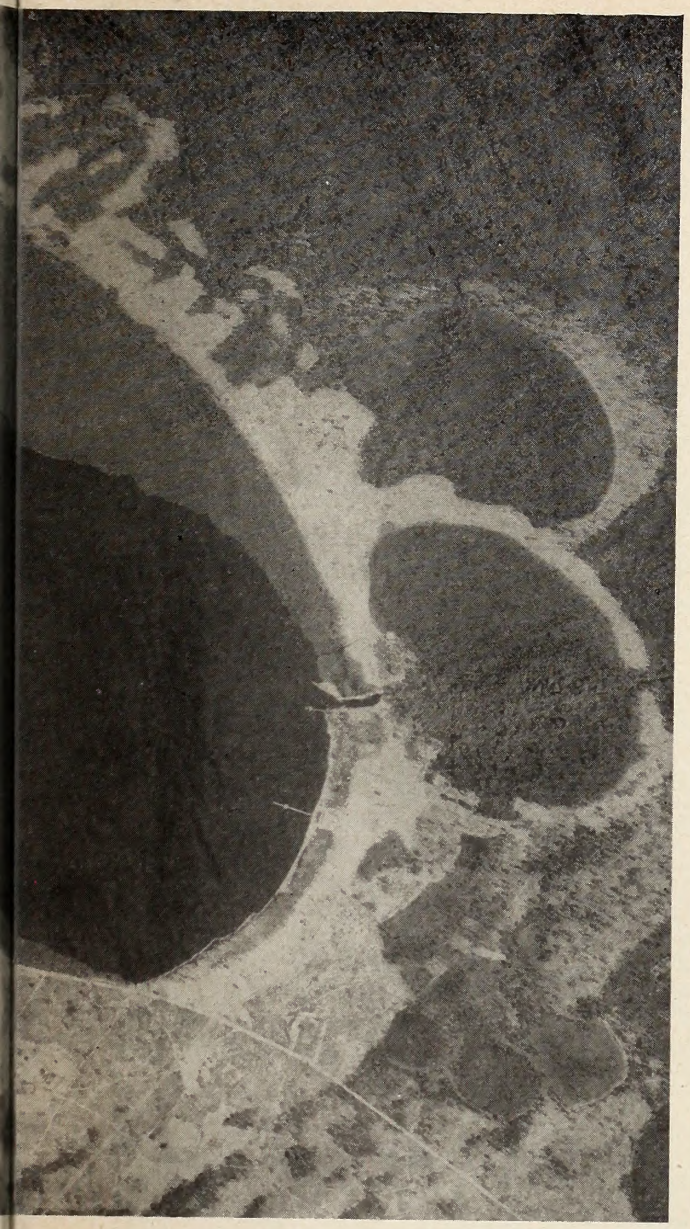
Middle Left: West shore of Black Lake. The sh
become established to the edge of the wat

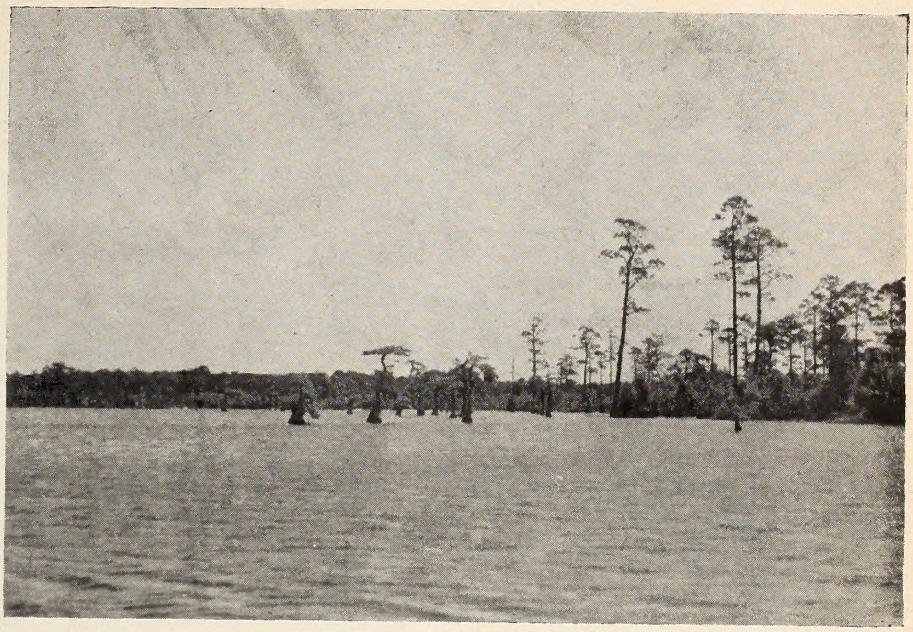
Lower Left: Dead trees, branches, and leaves
west sides of Jones Lake contribute to the

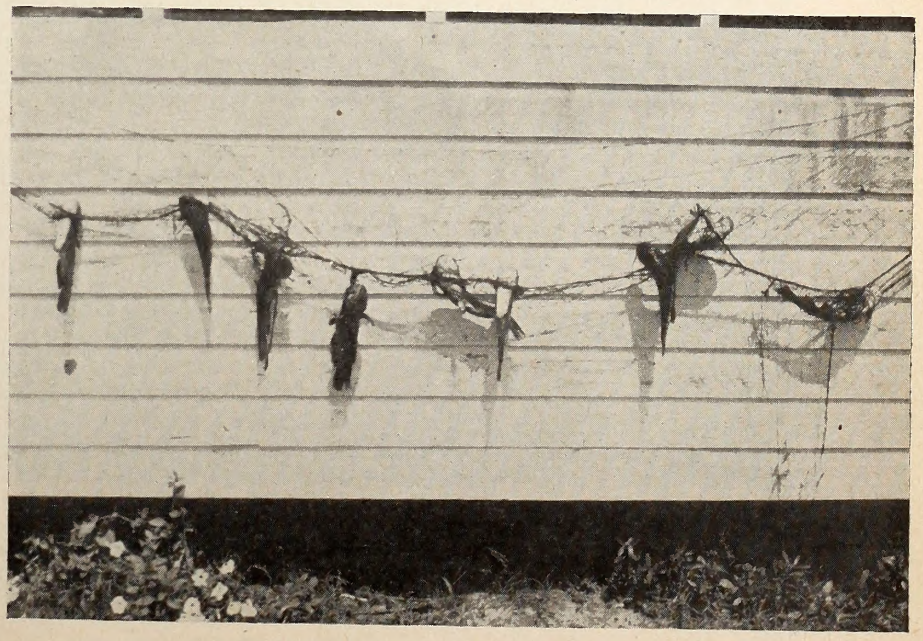
Upper Right: Cypress trees in the east end of S
can live although completely surrounded

Midle Right: Natural beaches such as this one
southeast shores.

Lower Right: Yellow bullheads caught in a g
Bay Lakes, and may be fairly abundant.







NA'S BAY LAKES

he encroachment of vegetation which is occur-

uring low water periods, continue to grow when reas.

line has filled in sufficiently to allow pines to

m the impenetrable growth along the north and anic deposits which are filling in the bay.

letary Lake. Once these trees start growing, they water.

Singletary Lake are confined to the east and

et set in White Lake. This species occurs in all

origin. Each is a single depression basin, approximately oval in shape, with a fairly regular shoreline. The lakes, vary in size from 224 acres in Jones Lake to 1,418 acres in Black Lake. Yet, in spite of their relatively large size, the lakes are shallow, with the deepest place found anywhere being 11.8 feet in Singletary. Black Lake, the largest, is likewise the shallowest, being just over 7 feet deep in one small area. White Lake has the greatest mean depth (7.5 feet)—and Black Lake has the least mean depth (5.3).

In Singletary, White, and Black lake, the deepest part of the lake is at the southeast end within 1,000 feet of shore, whereas in Jones and Salters the deepest place is in the approximate geographical center of the lake. All the lakes, however, exhibit a steep slope at the south end, which in all instances is the steepest bottom gradient found anywhere in the lakes. The filling in by vegetation at the northwest end has produced vertical banks with depths at the shore line up to as much as 4 or even 5 feet. Such depths of water greatly retard further spread of vegetation into the lakes, because it is only under very exceptional conditions that the lake bottom would be exposed, thus permitting a new generation of cypress to become established. Further extension of the vegetation must wait upon reduction in depth of water resulting from the very slow accumulation of peat along the shore.

The lakes are shallow and roughly saucer-shaped, with the bottom dropping off, sometimes sharply, at varying distances from shore to a large area in the center which is almost flat. In consequence of the shape of the basin and the absence of very shallow areas, normal fluctuations in water level do not appreciably alter the area of the lake. Available evidence indicates that the water level of these lakes varies approximately 1.5 feet during the course of an average year. Natural sand beaches, if they occur at all, are confined chiefly to the southeast side of the lake. Black Lake and Salters Lake have virtually no exposed beaches. In these lakes the dense bay vegetation almost everywhere comes to the edge of the water, overhanging it for distances up to 10 feet. White, Singletary, and Jones Lakes have limited areas of natural sand beaches exposed at normal water levels. Elsewhere there is the same abundance of bay vegetation crowding the shores, overhanging them, and even growing out into the water.

Chemistry and Physics of the Lakes

All water occurring in nature contains various amounts of dissolved and suspended materials which greatly affect the characteristics of the body of water and influence the productivity of the water. Some of the dissolved and suspended substances may be beneficial, and others may be deterimental. In general the nature of these substances is determined by the character of the watershed which drains into the lake.

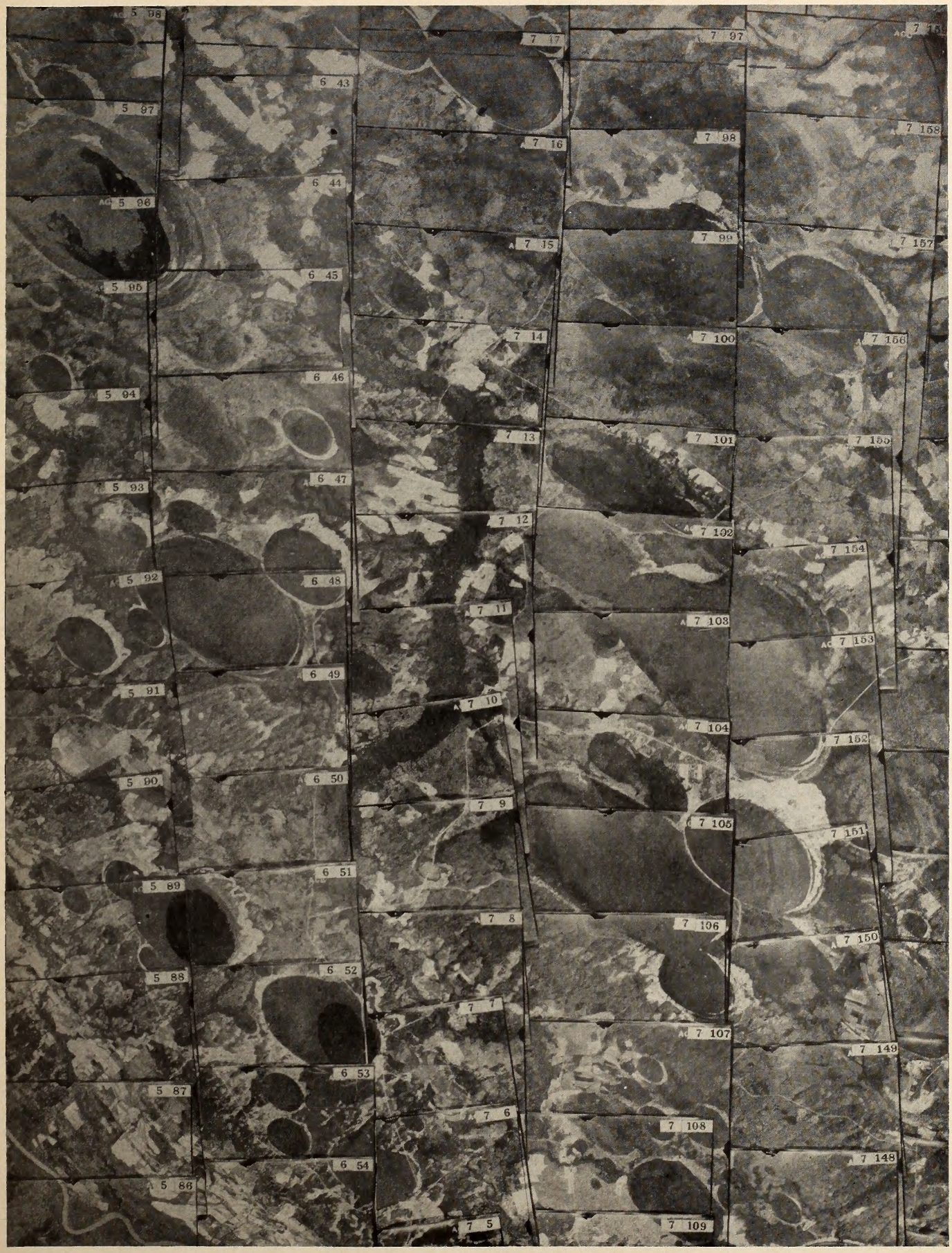
Light penetration is controlled primarily by the color of the water and the amount of suspended material. Jones, Salters, Singletary, and Black lakes have a low transparency primarily because of the high color they possess and secondarily because of quantities of fine suspended organic matter. White Lake had only small amounts of color and suspended material, so that the visibility disc was readily seen even on the bottom. Fish production, and the production of other organisms, in these lakes closely parallels the observed transparency.

One may wonder why White Lake, although so closely situated to these other lakes and resembling them in most other characteristics, does not have a dark color. The answer appears to lie in the drainage pattern which has been established. The outlets of Jones, Salters, Singletary, and Black lakes all occur towards the southeast or southwest end of the lake away from the region of maximum bay and peat formation at the northwest end. Vegetation growing on land gives rise to large amounts of humic acids and related compounds when it decomposes under swamp conditions, and it is these substances which impart the brown color to water. When rain falls on the accumulations of peat and vegetation at the north end of these lakes, large quantities of humic materials are dissolved from the peat, and since the only way most of this water can leave the basin is by flowing through the lake to the outlet at the south end, the materials are carried into the lake and color the entire body of water.

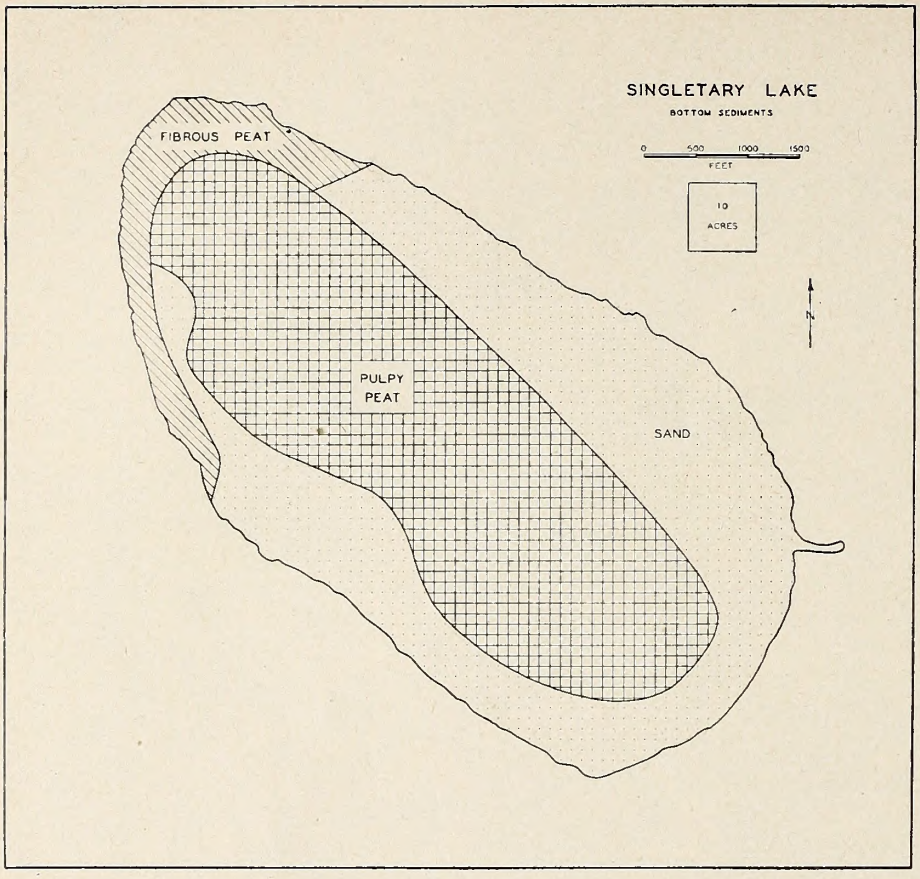
In White Lake, on the other hand, the outlet is located at the northwest end. Consequently, heavy precipitation is drained away from the lake rather than through the lake. The only humic acids entering the lake are from the relatively minor peat deposits along the east, south, and southwest sides. As an example of this effect of drainage pattern on the production and control of color in the lakes, on November 14 and 15, 1947, after a heavy rain a narrow zone of brown water could be observed in White Lake along the east and northeast shores. The center of the lake, however, still had a color of less than 10 parts per million, and there was no detectable increase in color along the northwest shore even immediately adjacent to all the vegetation where color would certainly be expected. However, at a bridge crossing the outlet approximately 3,000 feet from the lake and located just outside the edge of the bay containing White Lake, the water had a color of 440 parts per million.

Chemical reaction of the water, termed pH or hydrogen ion concentration, can influence the productivity of a body of water when it is excessively acid or excessively alkaline. All five lakes in Bladen County are very acid, with average pH values ranging from 4.3 to 4.9 The humic acids dissolved in water frequently affect the chemical reaction, but in these lakes they appear to have little effect, since the pH of White Lake which contains only small quantities of these materials is almost as low as that of the other four lakes. The carbon dioxide content of the water likewise is not the controlling factor, because bringing the carbon dioxide content of the water into equilibrium with that of the air does not change the pH perceptibly It seems likely that some form of sulphur, possibly sulfuric acid, is causing the high acidity of these waters. Many organisms, particularly the snails and mussels, are not able to tolerate acidity of this degree.

Oxygen, necessary for respiration of all fishes and most other aquatic organisms, is supplied to the water as a by-product of photosynthesis and from the atmosphere through the medium of



This remarkable aerial photo shows the general northwest to southeast contour of the Bay Lakes. The lakes are an enigma to the geologists, who do not agree as to how they were formed. Most dramatic theory is that a shower of meteorites gouged the earth's surface to form the lakes. Some lakes have been completely filled in with organic and other material. All are in the process of filling in.



wind action and circulation. The lakes are shallow enough to prevent temperature stratification of the water during the summer months, hence there is always an adequate supply of oxygen for fish from the surface to the bottom. It should be pointed out, however, that the quantity of oxygen in the water at no time approached saturation.

These lakes are all considered soft water lakes, low in calcium. It can be calculated from the data given in Tables I and II, for example, that 38 tons of limestone added to Jones Lake would neutralize the acidity of the entire body of water, assuming complete reaction. Black Lake would require 147 tons, and the other three lakes would require intermediate amounts.

Because of the shallowness of these lakes, the water temperatures tend to follow the air tempertures rather closely, preventing permanent stratification during the summer. No direct observations have been made of winter conditions, but inhabitants of the region report that infrequently, perhaps once every 5 to 10 years, the lakes become frozen over with a thin layer of ice.

The microscopic, free-floating plants and animals, collectively called plankton, and the small worms and insect larvae living in the bottom deposits constitute the main food supply of all fish or at least of their young. Samples collected from the lakes showed only meager quantities of plankton. These consisted of several species of minute animals (cladocera, copepods, and rotifers) and even smaller amounts of unicellular plants. Occasionally, though, the lakes are capable of greater production than they normally exhibit, as evidenced by a "bloom" of diatoms in Salters Lake in mid-July.

Bottom organisms consisted entirely of various kinds of insect larvae, several species of small worms related to the earthworm, and small numbers of scuds or "shrimp." The worms usually dominate in numbers and bulk. Each of the different types of bottom had different organisms associated with it. In general the deep-water sandy-bottom dark in color had the greatest production. The numbers of organisms ranged from none at all to more than 5,000 per square yard. Average numbers ranged from approximately 500 per square yard in White Lake to 100 per square yard in Salters and Black Lakes. The other two lakes produced intermediate quantities of these animals. The greater production of organisms in White Lake than in the others is correlated with the greater transparency of the water, permitting more photosynthesis to occur. However, even in White Lake production of bottom organisms would be considered quite low by ordinary standards.

Higher Aquatic Plants

Rooted aquatic plants do not grow at a depth greater than the penetration of light into the water. The four lakes with dark-colored water either had no aquatic plants at all, as in Black Lake, or had meager amounts of one or two species confined to the shallow water of coves and protected shores. Only White Lake had aquatic plants growing in deep water. In this lake 3 species of plants formed a rather loose, low carpet over much of the pulpy peat zone, growing successfully even in the deepest parts of the lake. It is interesting that as a result of the photosynthesis carried on by these plants, the oxygen content of White Lake was greatest at the bottom, whereas in the others it was greatest at the top.

The general scarcity or even complete absence of "weeds" in these lakes certainly affects fish production. Weed beds furnish shelter for the small fish and also furnish a suitable substrate upon which many organisms grow which can be used as food by fishes.

Production of Fish

One of the major functions of lakes in a recreational or land use program is to produce fish which can be caught for sport and food. The lakes of Bladen County have fish in them, but the sport fishing is usually not considered very good.

A total of 19 species of fish were collected in the five lakes, of which number 17 occured in White Lake, 12 each in Jones, Salters, and Singletary, and only 8 in Black Lake. The list of species present shows a preponderance of predaceous fishes and very few forage fishes. In a well-balanced lake forage fishes convert food from the small particles as they occur in plankton and bottom organisms into larger masses (the forage fishes themselves), which can be economically captured and consumed by the large

predaceous species. Where forage fishes are lacking or present in insufficient quantities, the young of the predaceous fishes serve as food for the larger individuals. It seems most likely that in these lakes the small yellow perch and the small chub suckers form the major source of food of the larger fishes.

In terms of numbers of fish present, the lakes can be arranged in a series which roughly parallels the quantities of bottom organisms in the several lakes. White Lake produces the most fish, Black and Salters least, Singletary and Jones intermediate quantities, with Singletary somewhat more productive than Jones.

Summary and Recommendations

The lakes of Bladen County are unproductive because of the dark color of the water, the high acidity, and probably from the scarcity of essential plant nutrients, resulting from the small size of their watersheds and the general infertility of the region in which they occur. Depending upon what uses are to be made of the lakes, various things might be done to change conditions in them.

1. It seems likely that by changing the outlet from the east end to the northwest end, the color of the lakes would be considerably reduced or even brought to the clear condition of White Lake. This would be expected to increase fish production through increasing photosynthesis and permitting a greater abundance and variety of aquatic plants.

2. The acidity of the lakes could be decreased by the addition of powdered limestone. Productive lakes are nearly always slightly to considerably alkaline. This treatment, if permanent, would permit the occurrence of such animals as snails and clams, and furnish a suitable environment for the bacteria which break down the compounds causing the water to be colored.

3. After a lake is clear enough for the nutrient materials to be efficiently utilized, fertilizers might be added to the water in an effort to boost the total amount of organic production. The cost of applying fertilizers to lakes of this size makes the practice hardly economical at this time.

Certain less extensive measures might also be recommended which would not alter the chemical and physical conditions of the entire lake, but only make fish production as effective as possible under the existing circumstances.

5. The outlet channel at Singletary Lake was found to be especially favorable for young game fish, small forage fish, and for the growth of aquatic vegetation. To increase fish production it might be found advisable to dredge out a number of similar channels or bays at various places in the lakes to provide spawning areas and nursery grounds for the small fish.

6. Suitable forage fishes, especially those which feed mainly on bottom organisms, could be introduced in an attempt to divert a larger percentage of the organic production into fish production, and to help reduce the excessive cannibalism in these lakes.

7. Beds of aquatic vegetation might be established by planting in suitable localities to provide shelter for small fish and greater production of food organisms. Only plants having a high tolerance for acid waters could be effectively used.

8. Brush, log, or stone shelters of various types would undoubtedly be useful in helping small fish escape from their enemies.

Whatever is done to the lakes it should be remembered that production in them is essentially low. Unless the general environmental conditions of the lakes are altered so that there is a greater production of bottom organisms and plankton, production will continue to remain low or only slightly improved, regardless of whatever else is done.

Note: A report on the fish population of these lakes will be given in a later issue of the magazine.

Table I. Some characteristics of the lakes of Bladen County, North Carolina

LAKE	Area Acres	Depth in feet Max.	Depth in feet Mean	Length Miles	Miles of Shoreline	Shoreline Development	Per Cent of Bay Filled in
Jones	224	8.7	6.1	0.8	2.19	1.05	66
Salters	315	10.1	6.9	0.9	2.70	1.09	51
Singletary	572	11.8	7.0	1.5	3.92	1.17	44
White	1,068	10.6	7.5	1.8	4.77	1.04	29
Black	1,418	7.1	5.3	2.1	5.91	1.12	40

Table II. Summary of average physical and chemical conditions in the lakes of Bladen County during the summer of 1947

LAKE	Number of Samples	Disc. Feet	Color ppm.	pH	ppm. CO_2 equiv. phenol.	ppm. CO_2 equiv. meth. or.	Dix. Oxygen
Jones	8	2.2	341	4.34	10.8	3.6	5.9
Salters	7	1.8	305	4.49	9.8	3.4	6.1
Singletary	10	2.5	170	4.52	6.8	2.9	6.4
White	8	11+	10	4.91	3.5	1.9	6.7
Black	6	1.8	181	4.40	7.6	2.1	6.4

Big Game Population Still Increasing

Big game animals in the United States increased their numbers by 25 per cent in the 3-year period from 1943 to 1946, the Wildlife Management Institute learned today from the U. S. Fish and Wildlife Service.

A tabulation based upon federal, state, and private estimates shows a population of 8,240,400 in 1946 in contrast to 6,598,422 in 1943, and 5,156,611 in 1937. Michigan led the states with a total of 880,600 animals, mostly deer. Wisconsin and Pennsylvania followed in second and third place with 795,600 and 679,600 respectively. Kansas alone has no animals of big-game stature.

One of the most gratifying gains during the three years was in the numbers of Rocky Mountain bighorn sheep. At one time on the verge of extermination, this splendid trophy animal registered a strong 75 per cent increase from 9,152 to 16,000. Moose population rose from 14,803 to 23,000, a gain of 57 per cent. An 11 per cent decrease in desert bighorns, however, was noted, although they still are slightly more numerous than they were 10 years ago. The prong-horn antelope dropped 5 per cent from 246,000 to 233,000. Over 100,000 more of these fleet animals exist on our plains today than in 1937, and the present slight decrease causes no grave concern. The black bear nearly doubled its numbers over the past ten years.

North Carolina Wildlife Club Activities

This Department is Devoted to the Organized Wildlife Clubs of This State

SEMIANNUAL WILDLIFE FEDERATION MEETING AT CHARLOTTE

A barbecue dinner and an address by the Honorable F. Donald Phillips, Judge of Superior Court, Rockingham, highlighted the semiannual meeting of the North Carolina Wildlife Federation held in Charlotte recently. The barbecue dinner was sponsored by the Mecklenburg Sportsmen's Wildlife Club of Charlotte. Judge Phillips spoke on wildlife management of Central European countries.

Although attendance was not all that might have been expected, the program followed at the two-day meet was of extreme interest and value to North Carolina sportsmen. Representing the Wildlife Resources Commission were: Commissioners D. K. Sing of Charlotte and R. Floyd Crouse, Sparta; Col. Clyde P. Patton, Executive Director, Raleigh; D. Warren Lupton, Chief of Law Enforcement, Raleigh; Hayden Olds, Chief of the Game Division, Raleigh; Rod Amundson, Chief of the Education Division, Raleigh, and nine Supervisors of Law Enforcement districts over the State. Several District Game Protectors also attended the meeting.

Other speakers were: C. R. Gutermuth, Wildlife Management Institute, Washington, D. C.; Chester S. Davis, Winston-Salem; Col. Frank L. Page, Honorary President, Wildlife Federation, Greensboro; Staton Inscoe, Raleigh; and Winfield Donat, Hampton, Va.

QUAIL PROJECT FOR BURKE COUNTY WILDLIFE CLUB

$1,200 Drive For Restocking Purposes

Jim Connelly, President of the Burke County Wildlife Club, has recently announced that the club is undertaking a drive to raise $1,200 for the purchase of 200 pairs of quail to be released in Burke County between April 1 and 10 for restocking purposes. The step is in keeping with the club's policy of building a closer understanding between the farmer and the sportsman.

The birds were bought from L. E. Erwin of Morganton, North Carolina. A $50 contribution from the Morganton Hardware Co. has already been received to start the drive funds.

Because of the successful results observed last year from 150 pairs of quail which were released, the Wildlife Club plans to make an annual event of releasing birds for restocking purposes until the State can take over the replenishing of game. Hunters claimed that more quail were seen last hunting season than had been seen in the past four years.

Also to be a part of the program of the Burke County Wildlife Club, is the furnishing of seed to farmers on whose lands birds are released, for the birds to be fed on. Farmers are asked to leave feeding strips in their grain fields as quail cover.

LINCOLN COUNTY

The Lincoln County Wildlife Club held a meeting at the High School Auditorium, April 14, at 8:00 p.m. The public as well as the members were invited and all farmers were urged to attend.

A program of motion pictures was presented and was particularly interesting to all who enjoy hunting, fishing, and all outdoor sports.

ROWAN COUNTY WILDLIFE CLUB ELECTS NEW OFFICERS

New officers of the Rowan County Wildlife Club were elected March 26 at a barbecue supper held at the Salisbury armory. W. G. Houck, well known Salisbury businessman and sportsman and also manager of the Rowan Equipment Company, was elected president of the Rowan County chapter of the North Carolina Wildlife federation for 1948. Mr. Houck succeeds E. L. Hardin, Salisbury investment broker.

Other officers named were Carl Hall, Jr., of Mount Ulla, vice president, and L. A. (Doby) Stirewalt of Salisbury, secretary and treasurer.

Clyde P. Patton, Executive Director of the N. C. Wildlife Resources Commission, was guest speaker. In his address Mr. Patton brought out many problems in the conservation of wildlife in the State. He explained that the existing shortage of game was due to the ever-increasing number of sportsmen and the depleted land conditions.

Mr. Patton further stated that farmers could assist in the conservation of game by including it in their farm program. He also pointed out the fact that sportsmen should hunt for the sport and for no other reason.

SAMPSON COUNTY

The Sampson County Wildlife Club held its regular monthly meeting in the courthouse, April 9, at 8:00. President John B. Williams presided.

The purpose of the meeting was to select delegates to the district meeting held in Kinston, April 12, therefore all members were urged to be present. Recommendations were formulated for the 1948-49 hunting season. All members were given an opportunity to be heard at this meeting and all proposed changes in the present hunting law were heard from by those who desired to express their views.

McDOWELL COUNTY

Rod Amundson of Raleigh, Chief of the Education Division of the North Carolina Wildlife Resources Commission, spoke to the McDowell Wildlife Club, April 5, at a meeting held at the Sugar Hill School.

In his talk, Mr. Amundson discussed the possible work which could be done by the local club.

Two short movies on wildlife were shown at the meeting. May 10 is the date set for the Club's next meeting.

RUTHERFORD COUNTY

At a recent meeting of the Rutherford County Wildlife Club, the following officers were elected: President, W. B. Robertson, Jr.; Vice President, J. U. Grose;

and Secretary-Treasurer, Thomas J. Edwards.

The club also has gone on record as urging the officers of the county to assist in the enforcement of the game laws; requesting the Wildlife Commission to let the fishing season remain the same as last year in Rutherford County; favoring additional deputy game protectors for the county by encouraging leading citizens in each township to apply for such positions; and advocating the raising of funds to restock quail, particularly on farms where quail are not found.

HALIFAX FISHING CLUB FORMED

Mr. C. E. Shaw was elected president of the newly formed Halifax Fishing Club, Inc., in Halifax, at a meeting of the club in early March. Other officers elected were: Quentin Gregory, Jr., vice president; J. H. Shaw, secretary-treasurer; J. S. Pope and W. R. Caudle, directors.

The club has had a road constructed and a parking lot cleared on the Roanoke River near Halifax. A landing has been constructed there for the use of the members.

It was pointed out that this was a new location and would not interfere with any other landings in use. The purpose of the new fishing club was to fix a private boat landing near Halifax and relieve congestion and unsatisfactory conitions at the other two landings in use.

POLK COUNTY

J. W. (Dick) Taylor, President of the Polk County Wildlife Club, attended the annual meeting of the Greenville County (S. C.) Sportman's Club in Greenville, March 1, as the guest speaker of Charlie (Woods Rider) West, a charter member of the South Carolina group.

Taylor told the Greenville sportsmen something of the club's quail restocking program in Polk County, and briefly outlined other current projects of the local group. He extended an invitation to his host to attend his club's spring field meet and evening program in Tryon to be held in May.

The Polk County Wildlife Club's second trap shoot was held at Joe McDowell's store, Green Creek township, April 3. The shoot began at 2:00, according to "Dick" Taylor, president of the club.

BERTIE COUNTY

The annual Spring "get together" of the Bertie County Wildlife Club was held at Colerain Beach, on the afternoon of April 30. The meeting was open to the public and began at 3:00. An old-fashioned fish muddle supper was served at 5:00.

Highlighting the meet was an exhibition of plain and fancy shooting by Wilbur E. Cox, expert marksman representative of the Remington Arms Company. In his demonstration, Cox included shooting with several shotguns of various gauges and several type and caliber rifles. The unusual exibition was thoroughly enjoyed by an enthusiastic group.

Mrs. E. V. Fites at Fairfield writes that "bone-chilling" winds and high tides have played havoc with good fishing in the Alligator River. The same climatic conditions however have proved to advantage in drainage canals around Mattamuskeet. She states that crappie seem to bite well when bass and white perch are difficult to lure. Mrs. Fites reports that bass have been biting in the Fairfield canal to suit any fisherman.

ORANGE COUNTY

The Orange County Wildlife Club held its monthly meeting April 16 at 8:00 at the Richard Webb Cabin. Plans were discussed for the shooting exhibition to be held April 22 by W. E. Cox, representative of the Remington Arms Company. Posters were placed in store windows announcing the time and place of the exhibition.

Krug Appoints Conservation Advisory Committee: A seven-member advisory committee to assist the Department of the Interior in the planning and administration of programs pertaining to recreation, wildlife, and related resources has been named by Secretary of the Interior J. A. Krug, the Wildlife Management Institute reported today.

Members of the group are: Shirley W. Allen, Society of American Foresters, Washington, D. C.; Dr. Ira N. Gabrielson, Wildlife Management Institute, Washington, D. C.; Kenneth A. Reid, Izaak Walton League of America, Chicago, Illinois; Fairfield Osborn, New York Zoological Society, New York City; Miss Harlean James, American Planning and Civic Association, Washington, D. C.; Bestor Robinson, Sierra Club, San Francisco; and Charles Moore, Dude Ranchers' Association, Dubois, Wyoming.

Vogt Becomes Book-of-the-Month Club Author: William Vogt's latest book, *Road to Survival*, selected by the Book-of-the-Month Club, is scheduled for an early fall release, the Wildlife Management Institute reported today. This award-winning treatise deals with the conservation of natural resources in the Americas and emphasizes the necessity for quick action to preserve present living standards—if not our very civilization—through sound utilization of our natural wealth.

Vogt, chief of the Conservation Section, Pan-American Union, Washington, is a biologist and conservationist of wide esteem. His work in the Western Hemisphere, in both North and South America, is the subject of wide acclaim. He is the author of "Audubon's Birds of America" and numerous scientific papers. His broad experience and travels eminently qualify him to author so important a book.

PRIZES WILL BE GIVEN FOR BEST WILDLIFE BORDER STRIPS

By MACY HOYLE

Rules and prizes have been announced for the wildlife border strip contests for Johnston County farmers and 4-H Club members. The two contests are being sponsored by the Johnston County Wildlife Club as the organization's first project of this type.

Prizes to be awarded amount to $125. The awards for the farmer and the 4-H contests are the same: $25 for the first place, $15 for second and $10 for third. In addition two 4-H Club members will be awarded expense-

To Wildlife Club Officers:

You are invited to send us news items concerning the meetings of your club. Good pictures of your group or its projects will be welome.—Ed.

paid trips to the 4-H wildlife camp.

The soil conservation service and county agent's office are cooperating in the sponsorship of the project.

Plans for bicolor and sericea lespedeza seed are available free of charge to participating farmers and 4-H members from the soil conservation service.

Any farmer who owns or operates a farm in Johnston County may enter the farmer contest. Food patches shall be woodland strips of bicolor lespedeza and field border strips of bicolor lespedeza and sericea lespedeza.

The woodland strips are to be planted one-eighth of an acre in size so as to produce sufficient food for a covery of quail. They will be planted in five rows three feet apart. The length of the rows shall be 400 feet or two plots 200 feet long within 20 feet of each other.

C. W. Warrick, soil conservationist, explained that suitable places are found in old tobacco beds, under power or telephone lines or cleared spots in cut down areas.

The field borders are to be planted the full length of woods bordering the field in five rows three feet apart. A 12 to 15 foot border of sericea is to be broadcast next to the field for turnip and cover.

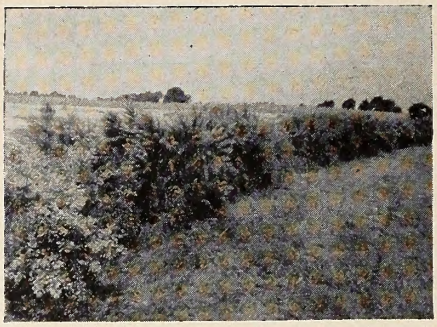
A farmer to be eligible for the contest must have one-eighth of an acre of wildlife for each 25 acres of land or as much as two acres to the largest farm.

A well-prepared seed bed is needed on well-drained soil. Eight hundred to 1,000 pounds of 2-12-12 fertilizer per acre is to be used at planting time. The fertilizer should be applied to the side so that the roots of plants will not come in direct contact with the fertilizer.

Rows shall be five in number and spaced three feet apart. Plants should be spaced two feet apart in the row. Farmers should cultivate two or three times the first year or keep it clean.

Bicolor lespedeza has earned a place in the management of land in the southeast, declared Warrick. The seeds are taken readily by bobwhites, the bark and leaves are eaten extensively by rabbits and the flowers are attractive to honey bees.

Bicolor is a dependable plant which will live many years without replanting. At least one plot in the south is more than 50 years old. It withstands burning, disking, cutting or rabbit use in the winter. It will control erosion. It is attractive in appearance.



Lespedeza bicolor plantings supply quail food during critical winter months.

Bicolor is a shrub that grows five to 10 feet high. It is a perennial plant which leafs out each spring as do other woody shrubs. Food strips in woodland will attract coveys as soon as the seed is produced.

County Agent John E. Piland said the contest for 4-H Club members would be run in accordance with the regular 4-H wildlife conservation project, with border and woods strip included.

THINGS YOU MAY NOT KNOW

An outstanding characteristic of the oyster is its ability to change its sex from year to year, a phenomenon known as "sex reversal." Young oysters in their first year of life are generally male. During the second year, half of them will become females and a certain number will continue to alternate between one sex and the other.

Birds are desended from reptiles and, like these ancestors, they do not perspire.

Oddities From Annals of National Safety Council 1947

When a sparrow smokes in bed and a cockroach kicks a man down the stairs, things are getting good and wacky. But that's what happened in 1947.

And that isn't all. A dead deer shot a hunter. A mouse upset a truck, a quail committed suicide, and some busy little bees boarded a street-car and caused a honey of an accident.

Yes, the annual roundup of odd accidents by the National Safety Council reveals that animals stole the show in 1947. To wit:

Firemen in Camden, N. J., spent an hour looking for the source of smoke that poured through the home of Mrs. Marie Baugher. They finally found it—a bird's nest under the roof. A sparrow had carried home a lighted cigaret. And just to prove that smoking in bed isn't restricted to sparrows, a pigeon in Washington started a fire in an apartment building the same way.

The celebrated case of the cantankerous cockroach occurred in Detroit and involved John Nantico, a bakery employee. Mr. Nantico said he was ascending stairs made slippery by spilled cake frosting when he looked into the leering eyes of the biggest cockroach any man ever saw. Mr. Nantico aimed a knockout kick at the roach with his right foot. The roach ducked. Mr. Nantico's left and anchor foot slipped in the frosting and he hurtled end over end to the floor below. His kicking leg was broken. The cockroach appeared pleased.

A lot of hunters shoot deer, but not many deer shoot hunters—especially if the deer are dead. But a dead deer did shoot Clarence Gerkin of Hudson, Colo., in a neat bit of posthumous vengeance. Mr. Gerkin had shot the deer and was preparing to dress it when a reflex kick by the animal hit his gun and discharged it. The bullet tore through Gerkin's left arm.

It is customary each year, of course, for a mouse to run a car into a ditch by merely sharing the car with a lady driver. But this year the mouse got big ideas and decided to tackle a truck. Just to do it the hard way, he selected an army truck, in Daventry, England. The driver, 19-year-old Christine Woodward, had been trained, as a member of the British Women's Land Army, to face bombs, bullets and battle without flinching. But they hadn't thought of training her to face a mouse. So when the ambitious little animal scampered across Miss Woodward's toes, she just did what came naturally. She fainted. The truck went into a ditch, Miss Woodward went to the hospital and the mouse swaggered back to the field.

Far less intrepid was the suicidal quail that found itself looking down the barrel of a gun

held by Gene Hatfield in Joplin, Mo. Realizing the jig was up, the quail decided to end it all. It flew straight against the barrel of the gun and dropped at Hatfield's feet with a broken neck.

Possibly stung by the high cost of living, bees apparently quit riding in private automobiles in 1947 and democratically took to streetcars. A merry group of them informally boarded a trolley in Cincinnati through an open window and evinced high interest in Motorman Earl Armstrong. As Armstrong frantically batted at his bumbling passengers, the streetcar bumped an automobile, which rammed the rear of another, which rammed the rear of another. Meanwhile, buzz, buzz, buzz went the trolley.

Fishermen Katsumi Nishitawa and Woodrow Wakatsuki would have broken all records for a catch of Santa Monica, Calif., one day this summer had it not been for one thing. They hauled in so many mackerel the weight of the fish sank the boat.

The Ivory Gull is found in the Polar Sea at 85 degrees North, less than 350 miles from the Pole, the most northerly record of any bird.

The female cod fish lays two million eggs a year.

The Carlsbad Cavern bats eat several tons of insects each night.

More than 300,000,000 pounds of fish and shellfish are landed annually at East Coast ports from Rhode Island to Virginia.

The polar bear is such a good swimmer that they have been seen over 200 miles from land in the open ocean.

Ducks see entirely different objects with each eye. Their binocular vision is limited to a narrow band ahead, upward and backward.

One of the most remarkable creatures in the world is the lungfish. It lives to be more than one hundred years old, buries itself in the mud, forms a cocoon, sleeps from one to five years, can exist without food by living on its own fat and body tissues, possesses lungs as well as gills, looks an eel and lives much like any other fish except that it must rise to the surface to breathe.

Confiscation of illegal fish nets is one of the important activities of the law enforcement staff. Game Protector J. O. Teel, Greenville, stands beside a boat load of illicit nets taken from Pitt County streams.

Two More Children's Museums Organized

Two more cities in North Carolina, Charlotte and Durham, have opened Natural History Museums as aids to the teachers in the public schools. These museums are endeavoring to bring before the children simple study plans, specimens to observe and practical materials with which to work in any courses dealing with natural history and science.

Charlotte utilized the old Sunshine school at 325 North Cecil Street. The museum is just across the street from the Armory and immediately behind the High School. The location is excellent but already space is inadequate. Russel Peterson, an accomplished taxidermist, artist and biologist, is the museum director. Assisting in lectures, guides and arrangements are capable teachers and interested persons of the area. The following schedules have been set up: Tuesdays, 3:30 p.m., Nature Club for junior and high school students; Wednesdays, 3:30 p.m., Junior Nature Club for elementary schools; Fridays, 3:30 p.m., Nature movies; Saturday, 10:00 a.m., Nature movies, 11:00 a.m., Nature art class, 2 p.m., Field trip, 3 p.m., Nature movies, 4 p.m., art class.

Mr. Arthur Jones, of the National Recreation association and a member of the Board of Directors of Charlotte's Children's Nature Museum, expressed hope that the Museum's program would reach through the schools, homes, and agencies to all children in Charlotte.

"We want to open the door to Mother Nature's cupboard where she keeps her treasures," Mr. Jones said in a recent statement at the museum, "We are proud of our professional and volunteer staff which is unique in this region. Children will learn to appreciate and understand more of the world in which they live and will serve."

At Durham, the Children's Museum is nestled quietly among stately pines and near the city water lake. An old residence has been utilized with the entire first floor devoted to displays, specimen birds and mammals, a seashell collection and other natural history material. The arrangements are excellent and lighting is good. In addition to natural history the museum has stressed other interests. Events, people and places important in the development of Durham are emphasized. Documents, pictures and relics are intriguingly shown. The interest shown in the museum by children and adults too, indicates a likely need for expansion in this type of public display and education work.

This column is devoted to sportsmen who have questions about hunting and fishing and wildlife in general. Our purpose is to select the most interesting questions and to give our readers the most accurate answers possible. Some questions just cannot be answered. Others may require research. We will do the best we can, with facts obtained from our biologists.

George J. Hatley, 401 N. Person St., Raleigh, writes:

"I am interested in bass fishing, but have never used a rod and reel. Could you tell me which would be best for a beginner, a fly rod or casting rod? Some tell me to use a fly rod, others advise me to use a casting rod. Would you please help a beginner?"

Old Solomon himself would be stumped with this one. We suggest trying both, to see which you find easiest, and which gets you the most fish and fun. Both will require considerable practice. Fly fishing is considered a little more difficult than bait casting, but even a small fish on a light flyrod feels like a monster.

* * *

C. M. Gattis, 324 E. Peace St., Raleigh, is concerned with using high-power loads in old-style shotguns. He writes:

"Printed on the heavy-load shotgun shell box is: 'Caution: Do not use in guns with twisted barrels.' Can you explain what is meant by a twisted gun barrel?"

There are a number of shotguns in existence, most of them quite old, which have barrels constructed from metal strips which have been wound into a spiral or "twisted" to form the barrel. These guns were made for the old-fashioned shell load. Using the new high-power shells might be dangerous. Some of these old spiral or twisted barrel guns have blown up—fatally.

H. R. Garris, 3220 Bedford Avenue, Raleigh is another fisherman confused by the common names of fishes. Aren't we all? Mr. Garris writes:

"Are fresh-water Speckled Perch, Goggle Eye and Crappie one and the same fish?"

We could write an article on this. North Carolina has two species of crappies, the white crappie (also called white perch, chinquapin perch, silver perch) and the black crappie. The latter is frequently called speckled perch or goggle-eye. To add to the confusion, the rock bass, a fish somewhat similar to crappies, but having rather large, red eyes in the males, is frequently referred to as "goggle-eye." Common names, at best, are confusing. That is why scientist refer to the white crappie as *Pomoxis annularis* Rafinesque, the black crappie as *Pomoxis nigro-maculatus* (LeSueur), and the rock bass as *Ambloplites rupestris rupestris.* Those scientific names are a little cumbersome, but the boys who use them know what they are talking about. For complete information on common North Carolina fishes, write for a copy of Dr. Willis King's very excellent pamphlet: Important Food and Game Fishes of North Carolina (Price 25c).

* * *

Snakes are one of the most misunderstood forms of wildlife. Here is a snake question that is not about a snake. The writer is Heimo R. Litzaw, 112 Harrison Ave., Raleigh.

Can you top this? John Rebak, Jr., with an 11-pound largemouth bass taken from Lake Hiwassee in April. The big fish measured 27 inches from end to end, and is probably the biggest bass yet to be taken from Hiwassee waters. Rebak used a casting rod and a Dive-oreno plug.

"My father-in-law claims that he saw a snake, struck at it, and saw it fly into three separate pieces and wriggle off. He says that this snake is known as a "glass" or "jointed" snake. Others here in Raleigh verify his statement to the extent that they, too, have heard of this particular snake. Personally, I am from California and am rather familiar with snakes. I doubt that any snake can fly apart and later rejoin itself, as people claim they can if none of the sections are destroyed. Is there such a snake?"

No. Nor can any lizard, which this "snake" happens to be. The so-called glass snake is a lizard. It is very brittle, especially in the tail region. When struck by a predator, the lizard can disjoint its tail vertebrae, leaving the pieces to wriggle in the grass. Once detached, these pieces can never get back to the fore part of the body. If not too seriously injured, the fore part of the body, which contains the head, trunk, and abdomen, can and will grow another, shorter tail.

* * *

This inquiry from Don H. Roberts, 120 E. Whitaker Mill Rd., Raleigh, has an interesting angle. Don writes: "How long would a bass weighing about 4½ pounds live with a flint stone about the size of a very large egg in his stomach? This fish was caught in a lake near Raleigh."

If the edges of the stone were not too sharp, the fish might have lived out the normal span of years. A 4½-pound bass has a large stomach capacity (he can swallow a 1-pound fish) and if the stone bothered his digestion, his stomach would probably give it a coating of tissue and go on digesting food. It is possible that the bass could have regurgitated the stone if he so desired.

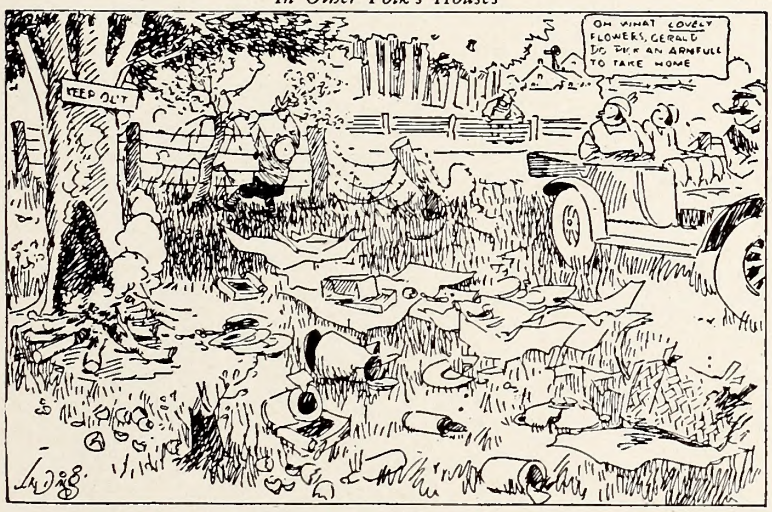
* * *

Note: If you have a question concerning wildlife which has been bothering you, jot it down on a postcard and send it in. You need not send any box tops, bottle caps, or labels. On the other hand, we can't pay for the material used.—Ed.

Some snakes have been known to live from one to two years without food by absorbing the fat of their own bodies.

IF WE TREATED OUR HOMES AS WE DO OUR WOODS. . . .

What A Lucky Thing Folks Never Took To Holding Picnics In Other Folk's Houses



Moral: Take Your Indoor Manners With You When You Go Outdoors

By P. L. RICKER, President
Wild Flower Preservation Society

Wild flowers, as well as all of our other natural resources, should be used wisely. In our more populous areas they are disappearing more rapidly than any other comparable resource. Even in many of the "wild areas" some of the most valuable and delicate forms face a grim struggle for survival.

Much of our wild flower destruction is due to advancing civilization, such as clearing for farm land, increased grazing, commercial developments, and to fires. Except to prevent unnecessary burning, there is little we can do to stop this loss.

There is one source of tremendous loss, however, that each and every one of us can help to minimize and that is the toll taken by our "nature lovers."

Raids as depicted by Mr. Darling are much more common than are generally believed. Anyone who has enjoyed, studied, and photographed wild flowers in wilderness areas has witnessed some destruction, and near large cities "wild flower raiders" are very common.

In the early days of road construction for the Shenandoah National Park many people were able to secure permits to preview this wonderful area. Doubtless, few abused the confidence, but on one occasion two carloads of adults were actually found on the Crescent Rock area with spades, trowels, and forks and were making it a shambles for the benefit of their personal wild flower gardens; and in the fall another large party was found stripping the mountain ash trees of their large clusters of beautiful bright-red fruits.

Because of so many other raids the Crescent Rock area was largely denuded of its former extensive rock garden flora and has shown little recovery over a ten-year period. Doubtless other national and state park areas throughout the country were similarly treated before a more strict supervision was provided.

It does not take much imagination to see what happens in wild areas less closely supervised.

Education and public sentiment is the sure-fire way to prevent this needless destruction. Public sentiment is particularly effective.

One example stands out in my mind. During World War I in the District of Columbia and vicinity, people were stripping the blossom-covered branches from the flowering dogwood trees in great quantities. They were urged through a three-week newspaper campaign to observe the results of their vandalism. The result was public sentiment brought to such a peak that audible criticism of anyone seen with dogwood branches put a stop to the raids, and the effects of the campaign lasted for many years.

Most of our native plants were doubtless placed on this earth for us to enjoy in moderation. Collecting of the flowers of a few species does little more harm than cutting roses from a bush. Unfortunately, many are injured by extensive picking.

Your part in the conservation of our wild flower resources is twofold. Think carefully before you pick, cut or dig; and, add your voice to the growing multitude who condemn the "wild flower raiders."

The bones of the sea cow (mermaid or manatee) are extremely dense and heavy for the purpose of keeping the animal down so that it can browse on acquatic plants.

Most spiders have eight eyes arranged in rows across the head.

Bamboo is the world's tallest grass.

A newly born kangaroo is only about one inch long and weighs approximately 1/350 of a pound.

What is said to be the largest duck to be taken in Minnesota in twenty-five years recently fell to the gun of Kenneth Peterson of Minneapolis. It was a Mallard Drake weighing over six pounds.

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"JOE BEAVER" By Ed Nofziger

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